

RULE 1104

Organic Solvent Degreasing Operations


(A) General

- (1) Purpose: The purpose of this Rule is to limit the emission of volatile organic compounds from wipe cleaning and degreasing operations using organic solvents.
- (2) Applicability: This rule applies to any facility engaged in wipe cleaning, cold solvent cleaning and/or vapor cleaning (degreasing) operations for metal/non-metal parts/products or electronic circuit boards, which utilize volatile organic solvents.

(B) Definitions

- (1) "Air-Vapor Interface" - The degreaser surface area between the sides of the cleaner, the top of the solvent-vapor layer, and the air touching this layer.
- (2) "Batch-loaded" - The material placed in a nonconveyorized container for a vapor or cold cleaning process.
- (3) "Cold Solvent Cleaning" - A process or activity, such as wipe cleaning, of removing soils from the surfaces of workloads by spraying, brushing, flushing, or immersing the parts with/in liquid solvent which is not heated or, when heated does not reach the solvent's boiling point.
- (4) "Cold Solvent Degreaser" - Any equipment using solvent which, if heated is maintained below the boiling temperature. Such equipment includes, but is not limited to, remote reservoirs, spray sinks and batch-loaded dip tanks.
- (5) "Condenser (primary condenser)" - The primary device, such as cooling coils, used to condense (liquify) solvent vapor.
- (6) "Condenser Flow Switch" - A safety switch connected to a thermostat which shuts off the sump heater if the condenser coolant is either not circulating or exceeds its designed operating temperature.
- (7) "Control Device" - A device for reducing emissions of VOC to the atmosphere.

- (8) "Conveyorized Degreaser" - Any continuously loaded, conveyorized cold solvent or vapor degreaser, including but not limited to gyro, vibra, monorail, cross-rod, mesh, belt and strip cleaners. Also strip degreasers which clean material by drawing the strip itself through the unit.
- (9) "Degreaser" - The solvent cleaning equipment used to clean soils from the surfaces of parts/workloads, and include the following types of equipment: cold solvent degreasers, vapor degreasers, conveyorized degreasers, and sealed chamber degreasers.
- (10) "Emulsion" - A suspension of small droplets of one liquid in a second liquid with which the first will not mix.
- (11) "Evaporation" - To change into a vapor, normally from a liquid state.
- (12) "Evaporative Surface Area for a Cold Solvent Degreaser" - The surface area of the top of the solvent.
- (13) "Evaporative Surface Area for a Conveyorized Degreaser " - (a) For a cold solvent degreaser, the surface area of the top of the solvent; or (b) For a vapor degreaser, the surface area of the top of the solvent vapor-air interface.
- (14) "Evaporative Surface Area for a Vapor Degreaser" - The surface area of the top of the solvent vapor-air interface.
- (15) "Freeboard Height for a Batch-loaded Vapor Degreaser" - The vertical distance from the top of the solvent vapor-air interface to the top of the degreaser.
- (16) "Freeboard Height for a Cold Solvent Degreaser" - The vertical distance from the top of the solvent to the lip of the cold solvent degreaser. For the purposes of this rule, remote reservoirs do not have a freeboard.
- (17) "Freeboard Height for a Conveyorized Degreaser" - (a) For non-boiling (cold) solvent, the vertical distance from the top of the solvent to the bottom of the first opening in the solvent containing compartment or to the bottom of the lowest opening in the degreaser, whichever distance is greater; or (b) for boiling (vaporized) solvent, the vertical distance from the top of the solvent vapor-air interface to the bottom of the first opening in the vapor containing compartment or to the bottom of the lowest opening in the degreaser, which ever distance is greater.
- (18) "Freeboard Ratio" - The freeboard height divided by the smaller of the inside length, diameter, or the inside width of the degreaser evaporative area.

- (19) "High Volatility Solvent" - Any solvent that is not classified as a low volatility solvent.
- (20) "Initial Boiling Point" - The boiling point of a solvent as defined by [ASTM Test Method D-1078-86](#). 
- (21) "Lip Exhaust" - A system which captures solvent vapors which escape from the top of an open top degreaser by directing the vapors away from persons operating the degreaser.
- (22) "Low Volatility Solvent" - A solvent with an initial boiling point greater than 120 °C (248 °F) and with an operating temperature at least 100 °C (180 °F) below the initial boiling point, as used.
- (23) "Make-up Solvent" - That solvent added to the operation to replace solvent lost through evaporation and other means.
- (24) "Refrigerated Freeboard Chiller (Secondary Condenser)" - A secondary cooling coil mounted above the primary condenser to provide a chilled air blanket above the solvent vapor-air interface and cause the condensation of additional solvent vapor.
- (25) "Remote (Enclosed) Reservoir" - A cold solvent degreaser with a tank which is completely enclosed except for a solvent return opening which allows used solvent to drain into it from a separate solvent sink or work area. The Return opening must be no larger than 100 square centimeters and the reservoir must not be accessible for soaking workloads.
- (26) "Sealed Chamber Degreaser" - A degreaser in which all spraying is contained inside the cleaning equipment.
- (27) "Soil" - Any surface contaminant which is to be removed by either cold solvent cleaning or vapor cleaning. Surface contaminants include, but are not limited to, for metal/non-metal cleaning operations: oils, greases, waxes, tars, stains, ink and/or particulate matter such as sand, metal chips, abrasives, or fibers. In addition, for circuit board operations, surface contaminants include the resist (a maskant) and flux from soldering.
- (28) "Solvent" - A liquid solution or vapor, which contains volatile organic compounds (VOCs), and which is used as a diluent, thinner, dissolver, viscosity reducer, cleaning agent or for other similar use. Typical degreasing solvents would dissolve oils, greases, waxes, or tars, to release and flush surface contaminants such as sand, metal chips, buffing abrasives or fibers and other soil-held surface contaminants from the surfaces of the workload. A solvent may be a single compound or a blend of two or more compounds.

- (29) "Solvent Leak" - The fugitive loss of three or more drops of liquid solvent per minute.
- (30) "Spray Safety Switch" - A manually reset switch which shuts off the spray pump if the vapor level drops more than 10 cm (4 inches) from the design operating height.
- (31) "Ultrasonics" - The enhancement of the cleaning process by agitation of liquid solvents with high frequency sound waves. The induced vibrations cause implosions of the microscopic vapor cavities within the liquid solvent. Such implosions within the solvent which is in contact with a solid surface, facilitates the removal of grease, dirt and other material from that surface.
- (32) "Vapor Cleaning" - A process using the condensation of vaporized solvent to remove/flush soils and soil-held debris from the surfaces of the workload.
- (33) "Vapor Degreaser" - Any degreaser that cleans through the condensation of solvent vapor on colder workload surfaces.
- (34) "Vapor Level Control Thermostat" - A manually reset safety switch which turns off the sump heater if the thermostat senses the temperature rising above the design operating level at the air-vapor interface.
- (35) "Volatile Organic Compound" - Any compound containing at least one atom of carbon, except for the following exempt compounds: methane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, ammonium carbonate, and those compounds listed in [40 CFR 51.100\(s\)\(1\)](#).
- (36) "Waste" - Material which may contain dirt, oil, metal particles, and/or other waste products concentrated after heat distillation of the waste solvent either in the degreaser itself or after distillation in a separate still.
- (37) "Wipe Cleaning" - That method of cleaning which utilizes a material such as a rag, wetted with a solvent, coupled with a physical rubbing process, to remove contaminants from surfaces. For the purposes of this rule, wipe cleaning materials shall not be considered "equipment".
- (38) "Workload" - The objects, i.e. parts, put in a cleaner for the purpose of removing oil, grease, soil, a coating, dirt or other undesirable matter from the surface of the objects.
- (39) "Workload Area" - (a) The plane geometric surface area of the top of the submerged parts basket; or (b) when no basket is used, the combined plane geometric surface area(s) displaced by the submerged workload.

(C) Standards

(1) EQUIPMENT REQUIREMENTS

- (a) All degreasers shall be equipped with the following:
 - (i) An apparatus or cover(s) which reduces solvent evaporation, except for remote reservoirs.
 - (ii) A permanent, conspicuous label summarizing the applicable operating requirements contained in section (C)(2)(b). In lieu of a label, operating instructions may be posted near the degreaser where the operators can access the proper operating requirements of this rule.
- (b) Remote reservoirs shall be equipped with the following:
 - (i) A sink, platform or work area which is sloped sufficiently towards a drain to prevent pooling of solvent within the work area.
 - (ii) A single or total drain hole area, not larger than 100 square centimeters (15.5 square inches) in area, for the solvent to flow from the sink (platform/work area) into the enclosed reservoir.
 - (iii) If high volatility solvent is used, a drain cover/plug/closure device or a cover for placement over the top of the sink (platform/work area), when the equipment is not being used, cleaned or repaired.
 - (iv) A minimum sink depth of six (6) inches, as measured from the top of the drain to the top of the side of the sink.
- (c) Cold Solvent Degreasers - Freeboard Requirements:
 - (i) Cold solvent degreasers using only low volatility solvents which are not agitated, shall operate with a freeboard height of not less than 6 inches.
 - (ii) Cold solvent degreasers using only low volatility solvents may operate with a freeboard ratio equal to or greater than 0.50 when the cold solvent degreaser has a cover which remains closed during the cleaning operation.
 - (iii) Any cold solvent degreasers using solvent which is agitated, or heated above 50 °C (120 °F) shall operate with a freeboard ratio equal to or greater than 0.75.
 - (iv) A water cover may be used as an acceptable control method to meet the freeboard requirements, when the solvent is insoluble in water and has a specific gravity greater than 1.

Cold Solvent Degreasers - Cover Requirements:

- (v) Cold solvent degreasers using high volatility solvent shall have a cover that is a sliding, rolling or guillotine (bi-parting) type which is designed to easily open and close without disturbing the vapor zone.

Cold Solvent Degreasers - Solvent Level Identification:

- (vi) A permanent, conspicuous mark locating the maximum allowable solvent level conforming to the applicable freeboard requirements.

- (d) Conveyorized Cold Solvent Degreasers shall be equipped with the following:

- (i) A rotating basket or other method, to prevent cleaned parts from carrying out solvent liquid.
- (ii) Minimized entrance and exit openings which silhouette the work loads such that the average clearance between material and the edges of the cleaner openings are less than 10 centimeters (4 inches) or less than 10% of the opening width, whichever is greater.
- (iii) A freeboard ratio equal to or greater than 0.75.
- (iv) Alternately, a hood or enclosure to collect emissions which are vented to a control device may be used to satisfy requirement (e)(iii) above, provided that the overall efficiency (collection efficiency multiplied by the control efficiency) of the total system shall not be less than 85 percent by weight. The collection system shall have a ventilation rate of 15-20 cubic meters/min per square meter of solvent cleaner opening (at each air-vapor interface), unless the rate must be changed to meet Federal and State Occupational Safety and Health Administration requirements, and is approved in writing by the District APCO.

- (e) Batch-loaded Vapor Degreasers shall be equipped with the following:

- (i) A cover that is a sliding, rolling or guillotine (bi-parting) type which is designed to easily open and close without disturbing the vapor zone.
- (ii) A vapor level control thermostat, a condenser flow switch and a spray safety switch.
- (iii) A freeboard ratio greater than or equal to 0.75.
- (iv) A primary condenser.

- (v) In addition, degreasers with an evaporative surface area greater than or equal to one square meter, shall be equipped with a refrigerated freeboard chiller for which the chilled air blanket temperature (degrees F) at the coldest point on the vertical axis in the center of the air-vapor interface shall be no greater than 30 percent of the initial boiling point (degrees F) of the solvent used, or 40 °F, which ever is greater. (If the chiller operates below the freezing temperature of water, it shall be equipped with an automatic defrost).
 - (vi) Alternately, a hood or enclosure to collect emissions which are vented to a control device may be used to satisfy the requirements of (d)(iii) and (d)(i) above, provided that the overall control efficiency (collection efficiency multiplied by the control efficiency) of the total system shall not be less than 85 percent by weight. The collection system shall have a ventilation rate of 15-20 cubic meters/min per square meter of solvent cleaner opening (at each air-vapor interface), unless the rate must be changed to meet Federal and/or State Occupational Safety and Health Administration requirements, and is approve in writing by the District Air Pollution Control Officer (APCO).
- (f) Conveyorized Vapor Degreasers shall be equipped with the following:
- (i) An enclosed drying tunnel or other method, such as a rotating basket, sufficient to prevent cleaned parts from carrying out solvent liquid or vapor.
 - (ii) Minimized entrance and exit openings which silhouette the work loads such that the average clearance between material and the edges of the degreaser openings are less than 10 centimeters (4 inches) or less than 10 % of the opening, which ever is greater.
 - (iii) A primary condenser.
 - (iv) A freeboard ratio equal to or greater than 0.75.
 - (v) A vapor control thermostat, a condenser flow switch, and a spray safety switch.
 - (vi) Additionally, a refrigerated freeboard chiller for which the chilled air blanket temperature (degrees F) at the coldest point on the vertical axis in the center of the air-vapor interface shall be no greater than 30 percent of the initial boiling point (degrees F) of the solvent used, or 40 °F, which ever is greater. (If the chiller operates below the freezing temperature of water, it shall be equipped with an automatic defrost).
 - (vii) Alternately, a hood or enclosure to collect emissions which are vented to a control device may be used to satisfy requirements of sections (f)(iv) and (f)(vi) above, provided that the overall efficiency (collection efficiency multiplied by the control

efficiency) of the total system shall not be less than 85 percent by weight. The collection system shall have a ventilation rate of 15-20 cubic meters/min per square meter of degreaser opening (at each air-vapor interface), unless the rate must be changed to meet Federal and State Occupational Safety and Health Administration requirements, and is approved in writing by the District APCO.

(2) OPERATING REQUIREMENTS

(a) All Degreasers shall comply with the following:

- (i) Any solvent cleaning equipment and any emission control device shall be operated and maintained in strict accord with the recommendations of the manufacturer.
- (ii) Degreasers shall not be operating with any detectable solvent leaks.
- (iii) All solvent, including waste solvent and waste solvent residues, shall be stored in closed containers at all times. All containers for any solvent(s) shall have a label indicating the name of the solvent/material they contain.
- (iv) Waste solvent and any residues shall be disposed of by one of the following methods: a commercial waste solvent reclamation service licensed by the State of California; **or** a federally or state licensed facility to treat, store or dispose of such waste; **or** the originating facility may recycle the waste solvent and materials in conformance with requirements of [Section 25143.2 of the California Health and Safety Code](#).
- (v) Degreasers shall be covered to prevent fugitive leaks of vapors, except when processing work or to perform maintenance.
- (vi) Solvent carry-out shall be minimized by the following methods:
 - a) Rack workload arranged to promote complete drainage
 - b) Limit the vertical speed of the power hoist to 3.3 meters per minute (11 ft/min) or less when such a hoist is used.
 - c) Retain the workload inside of the vapor zone until condensation ceases.
 - d) Tip out any pools of solvent remaining on the cleaned parts before removing them from the degreaser if the degreasers are operated manually.
 - e) Do not remove parts from the degreaser until the parts are visually dry and not dripping/leaking solvent. (This does not apply to an emulsion cleaner workload that is rinsed with water within the degreaser immediately after cleaning.)

- (vii) The cleaning of porous or absorbent materials such as cloth, leather, wood or rope is prohibited.
 - (viii) Except for sealed chamber degreasers, all solvent agitation shall be by either pump recirculation, a mixer, or ultrasonics.
 - (ix) The solvent spray system shall be used in a manner such that liquid solvent does not splash outside of the container. The solvent spray shall be a continuous stream, not atomized or shower type, unless, the spray is conducted in a totally enclosed space, separated from the environment.
 - (x) For those degreasers equipped with a water separator, no solvent shall be visually detectable in the water in the separator.
 - (xi) Wipe cleaning materials containing solvent shall be kept in closed containers at all times, except during use.
 - (xii) A degreaser shall be located so as to minimize drafts being directed across the cleaning equipment, the exposed solvent surface, or the top surface of the vapor blanket.
 - (xiii) A method for draining cleaned material, such as a drying rack suspended above the solvent and within the freeboard area, shall be used so that the drained solvent is returned to the degreaser or container.
- (b) Batch-loaded and Conveyorized Degreasers shall, in addition to the requirements in section (C)(2)(a), meet the following operating requirements:
- (i) When starting the degreaser, the cooling system shall be turned on before, or simultaneously with, the sump heater.
 - (ii) When shutting down the degreaser, the sump heater shall be turned off before, or simultaneously with, the cooling system.
 - (iii) The workload area shall not occupy more than half of the evaporative surface area of the degreaser.
 - (iv) Except for sealed chambers, the spray must be kept at least 10 centimeters (4 inches) below the top of the vapor level and be pointed downward, to prevent turbulence at the air-solvent vapor interface.
- (c) Remote Reservoir Degreasers shall, in addition to the applicable requirements in section (C)(2)(a), meet the following operating requirements:
- (i) The solvent pump shall not circulate solvent into the sink unless a workload is being actively processed.

- (ii) The sink of a remote reservoir degreaser or any container placed therein may not be used to soak a workload. Such use is prohibited and such use will cause the unit to be classified as a cold solvent degreaser and be subject to provisions of [section \(C\)\(1\)\(c\)](#) of this rule.
- (iii) Parts shall be visually dry and not dripping/leaking solvent before being removed from the sink. Parts shall be tipped to release any trapped pools of solvent before being removed from the sink.
- (iv) The workload must "drip-dry" while being contained completely within the sink.

(D) Prohibition

A lip exhaust system shall not be used on any degreaser unless it is vented to a hood or enclosure system as defined in [section \(C\)\(1\)\(e\)\(vi\)](#).

(E) Exemptions

- (1) The provisions of this Rule shall not apply to:
 - (a) Solvents Containing Less Than 2% VOC: Solvent cleaning/degreasing operations using total liquid solvent containing less than 2 percent by weight of volatile organic compounds (VOC).
 - (b) Small Cold Solvent Degreasers: Any cold solvent degreaser with a solvent surface area of less than 929 square centimeters (1 square foot) shall meet the requirements of [Section \(C\)\(2\)\(a\)\(v\)](#) and [\(E\)\(2\)](#) of this rule.
 - (c) Consumer products such as aerosol cans or small containers (one quart or smaller) unless the total accumulative use is greater than 160 ounces (five quarts) of solvent per day. Persons using these products are subject to [Section \(C\)\(2\)\(a\)\(iii, iv & xi\)](#), [Section \(E\)\(2\)](#), [Section \(G\)\(a\)\(v\)](#) and [Section \(G\)\(c & d\)](#) of this rule.
- (2) Any facility classified as exempt or claiming to be exempt under this [section \(E\)](#), shall meet the record keeping requirements of this rule so as to be able to prove the exemption status.



(F) Administrative Requirements

Rule 442 Applicability: Any solvent using operation or facility which is not subject to this source-specific rule shall comply with the provisions of Rule 442. Any solvent using operation or facility which is exempt from all or a portion of the VOC limits, equipment limits or the operational limits of this rule shall be subject to the applicable provisions of Rule 442.

(G) Recordkeeping Requirements

- (1) Solvent Usage Records All persons subject to this rule and any person claiming any exemption under Section (E) shall comply with the following requirements:
 - (a) Maintain and have available during an inspection, a current list of solvents in use at the facility which provides all of the data necessary to evaluate compliance, including the following information separately for each degreaser, as applicable:
 - (i) product name(s) used in the degreaser, and
 - (ii) the mix ratio of solvent compounds mixtures of solvents are used, and
 - (iii) VOC content of solvent or mixture of compounds as used, and
 - (iv) the total volume of the solvent(s) used for the facility, on a monthly basis, and
 - (v) the name and total volume applied of wipe cleaning solvent(s) used, on a monthly basis.
 - (b) Additionally, for any degreaser utilizing an add-on emission control device/system as a means of complying with provisions of this rule shall, on a monthly basis, maintain records of key system operating and maintenance data. Such data is recorded for the purpose of demonstrating continuous compliance during periods of emission producing activities. The data shall be recorded in a manner as prescribed by the District.
 - (c) Documentation shall be maintained on site of the disposal or on site recycling of any waste solvent or residues.
 - (d) Such records shall be retained on site (at the facility) and available for inspection by the Air Pollution Control Officer for the previous 24 month period.

(H) Test Methods

- (1) A violation determined by any one of these test methods shall constitute a violation of this rule.
- (2) The following specified test methods shall be used to determine compliance with the provisions of this rule.
 - (a) Determination of the VOC Content of Solvent Samples The determination of the volatile organic compound content shall be by the appropriate procedures contained in EPA Method 24.
 - (b) Determination of Initial Boiling Point of Solvents The initial boiling point of the solvent shall be determined by ASTM Test Method D1078-86. 
 - (d) Determination of Capture Efficiency Capture efficiency shall be determined by the appropriate procedures set out in 40 CFR 52.741 appendix B.
 - (e) Determination of Control Efficiency EPA Method 25, EPA Method 25A, or ARB Method 100 shall be used to determine control efficiency.
 - (f) Determination of the Ventilation/Draft Rate The ventilation/draft rate shall be determined by EPA Methods 2, 2A, 2C and 2D.
 - (g) Determination of Exempt Compounds Determination of the exempt compounds, shall be performed in accordance with ASTM Test Method D 4457-85 (Solvents and Coatings) and be consistent with the provisions set forth in the Federal Register (FR, Vol. 56, No. 52, March 18, 1991). Perfluorocarbon compounds shall be assumed to be absent from a product or process unless a manufacturer or facility operator identifies a specific compound or compounds from the broad classes of perfluorocarbons listed in 40 CFR 51.100(S)(1) as being present in the product or process. When such compounds are identified, the facility shall provide the test method to determine the amount(s) of the specific compound(s). 

(I) Compliance Schedule

Any person subject to any of the requirements of this rule shall comply with the following increments of progress:

- (1) On an after October 28, 1994 be in full compliance with the operating and recordkeeping requirements of this rule.

- (2) On and after September 28, 1995 be in full compliance with the equipment requirements of this rule.

[SIP: Approved: 4/30/96, 61 FR 18962, 40 CFR 52.220(c)(207)(I)(D)(2)]